

Glider Observations of Circulation Around an Island

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<http://chowder.ucsd.edu>

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LONG-TERM GOALS

A continuing interest in oceanographic research involves the observation and prediction of coastal circulation. A special branch of the coastal problem involves circulation around islands, which has been less studied over the years. Island circulation is distinguished from continental coastal circulation primarily by an island's small size relative to the scales of atmospheric forcing and general ocean currents. Relevant processes include boundary currents, eddies shed in the island's wake, and island coastally trapped waves. This project aims to improve the understanding of island circulation through observations using underwater gliders, with the ultimate goal of better prediction.

OBJECTIVES

Given a goal of quantifying island circulation, a sensible approach is to address the hierarchy of issues. The steady circulation around an island is a result of the large-scale wind field, and the oceanic general circulation in which the island is embedded. First, we plan to address the so-called "island rule" which supposes flow on the east side of the island is due to the integral effect of wind stress curl to the east of the island across the entire ocean basin. Second, we will address the effects of local wind may also force boundary currents on all sides of islands. Third, we expect wakes of eddies given that islands are often embedded in a larger-scale flow. Finally, we will examine the possibility of lee waves and topographically trapped waves.

APPROACH

We are making Spray glider observations from Palau to resolve the phenomena described above. We have extensive experience deploying gliders from Palau as part of the Origins of the Kuroshio and Mindanao Current project, making for convenient logistics. Palau is embedded in strong globally important currents, with the westward North Equatorial Current to the north and the eastward North Equatorial Counter Current to the south. Because of this unique location, Palau is an ideal laboratory for studying the complete suite of island circulation effects.

WORK COMPLETED

We have completed four Spray glider deployments during the past two years, focused on observing the boundary currents on the east side of the island (Figure 1). The gliders occupied two lines perpendicular to shore on the east side of the island. In addition to the standard Sea-Bird CTD and Seapoint fluorometer, each glider is carrying an ADCP to measure profiles of velocity to as deep as 1000 m. The intention is to evaluate the efficacy of the “island rule” along the coast of Palau. To date, we have collected 400 glider-days of data covering 7800 km over ground in 2200 dives. All data has been made available to modelers for assimilation.

During the next stage of observations, with the next deployment of two gliders to take place in October 2015, we will turn our focus to the observation of island wakes. The plan is to deploy one glider in the NEC upstream of Palau’s northern flank, and one glider downstream.

RESULTS

The western boundary current is evident in our measurements although it is quite variable in strength and direction. We hypothesize that the cause of this variability is the impingement of westward propagating eddies. This motivates an examination of island wake effects to observe the difference in the eddy field on either side of the island.

IMPACT/APPLICATIONS

All temperature and salinity data from gliders has been sent to NAVO in real time for assimilation into operational models.

RELATED PROJECTS

This project has benefitted directly from the logistical support established by the Origins of the Kuroshio and Mindanao Current (OKMC) DRI. OKMC gliders took relevant observations as they awaited recovery off the coast of Palau, and these data helped to form the hypotheses that motivate this project.

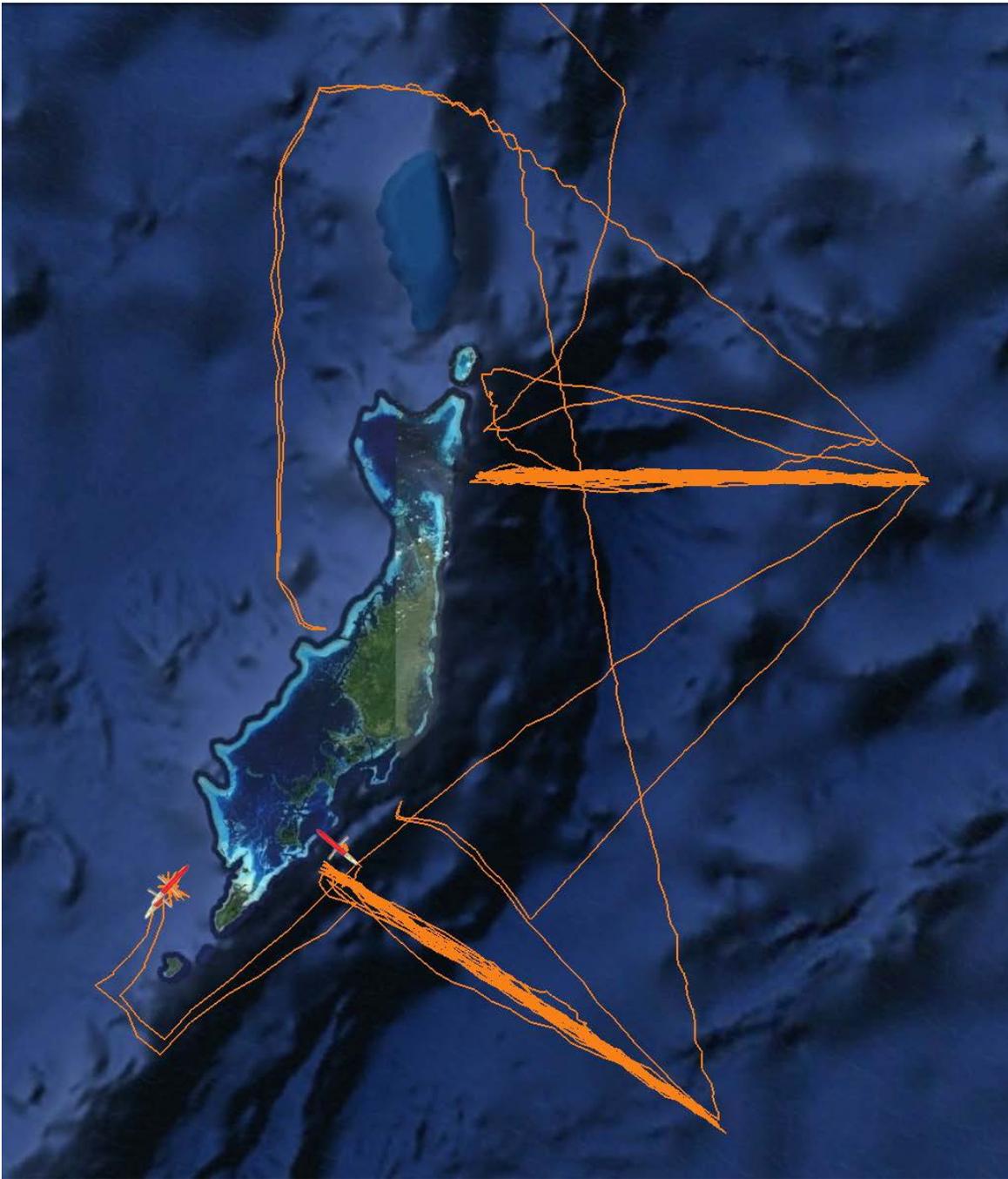


Figure 1. Spray underwater glider tracks off Palau during February 2014 – January 2015. The data set includes 400 glider-days covering 7800 km over ground in 2200 dives.